PURDUE UNIVERSITY | Extension ENTOMOLOGY
Issue: 2020.2
April 10, 2020
Pest&Crop newsletter
Purdue Cooperative Extension Service and USDA-NIFA Extension IPM Grant
This work is supported in part by Extension Implementation Grant 2017-70006-27140/ IND011460G4-1013877 from the USDA National Institute of Food and Agriculture.

In This Issue

Black Cutworm And Armyworm, Early Impressive Captures!

(John Obermeyer)

In looking over the black cutworm and armyworm pheromone reports, it is obvious that many moths have arrived into Indiana. Thanks to our trapping cooperators throughout the state! Still, at this point, many variables must perfectly align for these pests to cause a stir in high-risk fields.

First, understand that eggs are now just being laid on preferred plants. Armyworm are seeking lush grasses (e.g., wheat, cereal rye) while black cutworm target winter annual broadleaves (e.g., chickweed, dandelion). Currently, those fields are in abundance because of the typical spring-like conditions. After hatch, which takes about a week, the young larvae are most vulnerable to natural and man-made events. They are very prone to dramatic weather events, and natural enemies, e.g., ground beetles. They need a constant and healthy food source, only available if field work/herbicides are delayed for multiple weeks. Their death rate, even under ideal conditions, is very high.

Monitoring moth arrival, and numbers captured, is an inexact science. We cannot predict with certainty that high moth counts, which we are currently experiencing, will equate to high pest damage. Instead, it is best to understand the pest and how the next few weeks unfold. Stay tuned!

Armyworm moth captures in a Hartstack trap.

Black Cutworm Trapping, A Student's Perspective

(Cameron Pheromone Trapper)

EDITOR'S NOTE: Cameron, sophomore in high school, has agreed to take over his dad's monitoring during this reprieve from formal education. Because of his interest in entomology, he wrote the following article, to remind us why we trap for these moths every spring. We welcome other 9-12 (biology and agronomic) citizen scientist's contributions, including pictures/drawings, let us know (obe@purdue.edu).

Black cutworms migrate from Mexico and Texas to the Midwest during the months of late February to June. This insect affects many crops such as strawberries, sugarbeet, and rice. Although in the Midwest the black cutworm is considered to be one of the most major pests of corn. Black cutworms severely damage juvenile corn plants.

The damage caused by this pest is most severe when corn is less than six inches in height. They normally would cut a small hole just below the surface of the soil then would pull it under the surface to then feed on the plant. It is important to monitor or keep track of the black cutworm because the information collected from monitoring will tell the farmer when the peak of this pest should arrive. Monitoring now helps with integrated pest management for later on in the season.

References:

http://entnemdept.ufl.edu/creatures/veg/black_cutworm.htm

https://extension.entm.purdue.edu/fieldcropsipm/insects/black-cutworms.php

http://extension.cropsciences.illinois.edu/fieldcrops/insects/black_cutwor

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Cameron checking his bucket trap for black cutworm moths.

2020 Black Cutworm Pheromone Trap Report

(John Obermeyer)

		BCW Trapped						
County	Cooperator	Wk 1 4/2/20-4/8/20	Wk 2 4/9/20-4/15/20	Wk 3 4/16/20-4/22/20	Wk 4 4/23/20-4/29/20	Wk 5 4/30/20-5/6/20	Wk 6 5/7/20-5/13/20	Wk 7 5/14/20-5/20/20
Adams	Roe/Mercer Landmark	12						
Allen	Anderson/NICK	1						
Allen	Gynn/Southwind Farms	2						
Allen	Kneubuhler/G&K Concepts	6						
Bartholomew	Bush/Pioneer Hybrids	6						
Clay	Mace/Ceres Solutions/Brazil	2						
Clay	Fitz/Ceres Solutions/Clay City	0						
Clinton	Emanuel/Boone Co. CES	26*						
Dubois	Eck/Dubois Co. CES	1						
Elkhart	Kauffman/Crop Tech	7						
Fayette	Schelle/Falmouth Farm Supply Inc.	46*						
Fountain	Mroczkiewicz/Syngenta	0						
Fulton	Jenkins/Ceres Solutions/Talma	0						
Hamilton	Campbell/Beck's Hybrids	15						
Hendricks	Nicholson/Nicholson Consulting	0						
Hendricks	Tucker/Bayer							
Howard	Shanks/Clinton Co. CES	–						
Jasper	Overstreet/Jasper Co. CES	0						
Jasper	Ritter/Dairyland Seeds	12						
Jay	Boyer/Davis PAC	19*						
Jay	Shrack/Ran-Del Agri Services	19*						
Jennings	Bauerle/SEPAC	16						
Knox	Clinkenbeard/Ceres Solutions/Freelandville	0						
Knox	Butler/Ceres Solutions/Vincennes	0						
Lake	Kleine/Rose Acre Farms	60*						
Lake	Moyer/Dekalb Hybrids/Shelby	4						
Lake	Moyer/Dekalb Hybrids/Scheider	5						
LaPorte	Rocke/Agri-Mgmt. Solutions	6						
Marshall	Harrell/Harrell Ag Services							
Miami	Early/Pioneer Hybrids	0						
Montgomery	Delp/Nicholson Consulting	2						
Newton	Moyer/Dekalb Hybrids/Lake Village	0						
Porter	Tragesser/PPAC	–						
Posey	Schmitz/Posey Co. CES	1						
Pulaski	Capouch/M&R Ag Services							
Pulaski	Leman/Ceres Solutions	31*						
Putnam	Nicholson/Nicholson Consulting	8						
Randolph	Boyer/DPAC	13*						
Rush	Schelle/Falmouth Farm Supply Inc.	1						
Shelby	Fisher/Shelby County Co-op							
Shelby	Simpson/Simpson Farms	0						
Stark	Capouch/M&R Ag Services							
St. Joseph	Carbiener, Breman							
St. Joseph	Deutscher/Helena Agri-Enterprises	2						
Sullivan	Baxley/Ceres Solutions/Sullivan	0						
Sullivan	McCullough/Ceres Solutions/Farmersburg	0						
Tippecanoe	Bower/Ceres Solutions	3						
Tippecanoe	Nagel/Ceres Solutions	36*						
Tippecanoe	Obermeyer/Purdue Entomology	0						
Tippecanoe	Westerfeld/Bayer Research Farm	0						
Tipton	Campbell/Beck's Hybrids	0						
Vermillion	Lynch/Ceres Solutions/Clinton	0						
White	Foley/ConAgra	5						
Whitley	Richards/NEPAC/Schrader	_						
Whitley	Richards/NEPAC/Kyler	–						

* = Intensive Capture…this occurs when 9 or more moths are caught over a 2-night period

Armyworm Pheromone Trap Report – 2020

(John Obermeyer)

County/Cooperator	Wk 1	Wk 2	Wk 3	Wk 4	Wk 5	Wk 6	Wk 7	Wk 8	Wk 9	Wk 10
Dubois/SIPAC Ag Center	724									
Jennings/SEPAC Ag Center	60									
Knox/SWPAC Ag Center	1162									
LaPorte/Pinney Ag Center	115									
Lawrence/Feldun Ag Center	974									
Randolph/Davis Ag Center	117									
Tippecanoe/Meigs	225									
Whitley/NEPAC Ag Center	–									

Wk 1 = 4/2/20-4/8/20; Wk 2 = 4/9/20-4/15/20; Wk 3 = 4/16/20-4/22/20; Wk 4 = 4/23/20-4/29/20; Wk 5 = 4/30/20-5/6/20; Wk 6 = 5/7/20-5/13/20; Wk 7 = 5/14/20-5/20/20; Wk 8 = 5/21/20 – 5/27/20; Wk 9 = 5/28/20-6/3/20; Wk 10 = 6/4/20-6/10/20; Wk 11 = 6/11/20-6/17/20

The Updated 2020 Fungicide Efficacy Tables Are Now Available For Corn And Soybean

(Darcy Telenko)

Each year the members of the Corn Disease Working Group and the North Central Regional Committee on Soybean Diseases (NCERA 127) with the support of the United Soybean Board establish ratings on the efficacy of fungicides for corn and soybean diseases. These ratings are intended to provide guidelines on efficacy of the various products for use in corn and soybean. The fungicide active ingredients listed were tested over multiple years and locations by the members of these groups. The tables are updated annually and include the most widely marketed products, but are not an exhaustive list.

The publications are available at the following links:

2020 Fungicide Efficacy for Control of Corn Diseases

2020 Fungicide Efficacy for Control of Soybean Foliar Diseases

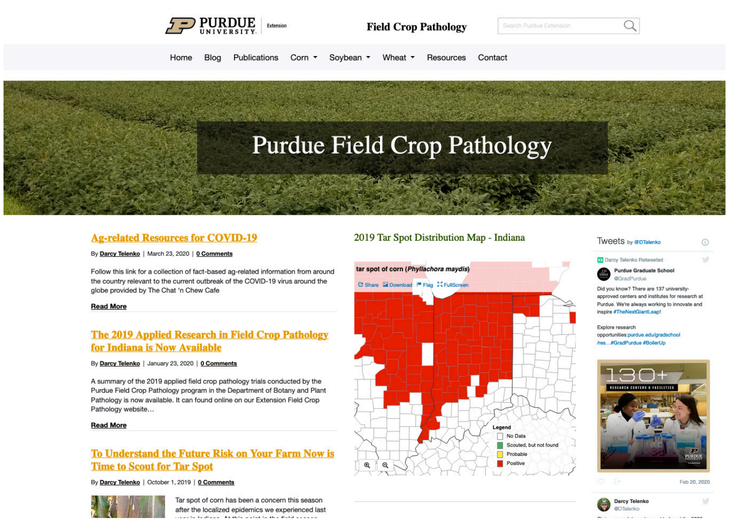
2020 Fungicide Efficacy for Control of Soybean Seedling Diseases

They can also be found under Crop Protection Network Resources https://cropprotectionnetwork.org/resources/publications

A new addition this year is product efficacy for tar spot of corn. Fungicide timing is going to be extremely important for tar spot and needs to be made near the onset of the first tar spot symptoms. The efficacy data for this disease was based on limited site locations from 2018 and 2019 and products will continue to be evaluated. In addition, a number of the fungicides have a 2ee label for tar spot, so it will be important to check if your state has this label for use.

Indiana specific data on the management of tar spot is also available in the Purdue Extension publication – Applied Research in Field Crop Pathology for Indiana – 2019

Indiana field crop disease updates and maps for the 2020 season will be available on the Purdue Field Crop Pathology Website https://extension.purdue.edu/fieldcroppathology/.



https://extension.purdue.edu/fieldcroppathology/

Soil Applied Herbicides And Rainfall For Activation

(Bill Johnson) & *(Marcelo Zimmer)*

Field work has progressed significantly in the past couple of weeks due to warmer temperatures. However, at this point there is still uncertainty on how the weather will develop in the next couple of weeks. As we approach mid-April many growers are ready to start planting as soon as conditions allow. Many of these acres will receive soil applied, residual herbicides for control of germinating weed seedlings. Soil applied pre-emergent herbicides require moisture for activation. What this really means is that we want the herbicide to be dissolved in the soil water (aka "solution") so it is able to be taken up by the germinating weed seedling root or shoot. When soil conditions are dry, herbicide molecules will remain closely associated with soil particles and not able to move into weed seedlings via mass flow processes. As a result, weed control with soil applied herbicides can be less than desirable under dry conditions.

We are asked quite often how much rainfall it takes to activate a soil-applied, residual herbicide. The answer depends on many factors, which include:

1) How water-soluble the herbicide is,

2) how sensitive the weed specie is to the specific active ingredient,

3) what stage the weed seedling is when exposed to the herbicide,

4) did the weed seedling receive a high enough dose to overcome any natural herbicide tolerance or metabolism mechanisms,

5) how moist was the soil when the herbicide was applied.

As you can see, the answer to the question "how much moisture is required to activate my herbicide" requires consideration of several factors.

A quick review of several herbicide (but not all) labels shows the following edited comments with regards to precipitation and herbicide activation. Table

As you can see, the answer varies a bit by herbicide. So, what we tell our clientele that ask these questions is following. Generally we would like to see 0.75 to 1 inch of precipitation within the first week. Also, we would like to see approximately 2 inches of precipitation spread out over the first two weeks after the herbicide was applied for optimal herbicide performance.

If 10-14 days have passed without rainfall following a Pre-treatment and weeds are starting to break, consider the following:

1. Start planning for a post herbicide application
2. Use a rotary hoe to dislodge small seedlings and buy some time for a precipitation event to activate the herbicides
3. Some herbicides can "reach back" or "recharge" on small annual weeds when rainfall occurs, although depending on this may be a little like buying a lottery ticket. The HPPD (Group 27) herbicides (Accuron, Balance, Corvus, Lumax, Lexar, Instigate, Prequel, etc.) tend to have better "reach back" potential than some other herbicides and escaped grass control is probably of greater concern. The Group 5 herbicides (Photosystem II inhibitors) like atrazine, simazine, and metribuzin will also control small emerged susceptible broadleaves via root uptake.

Spring Herbicide Applications On Winter Wheat

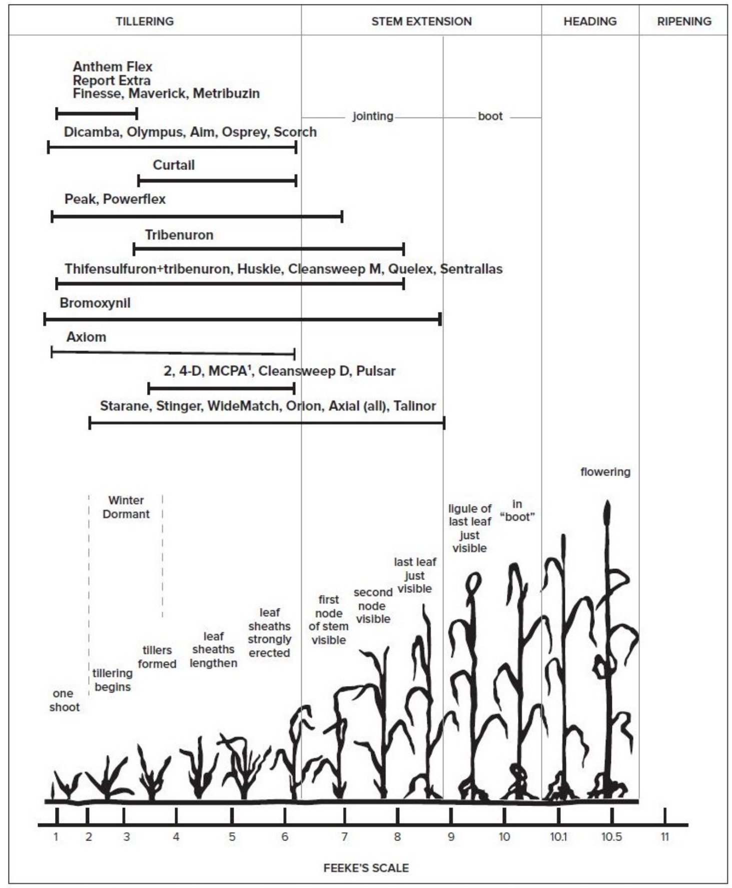
(Bill Johnson) & *(Marcelo Zimmer)*

The warmer temperatures in the past couple of weeks have allowed winter wheat fields in Indiana to green up and resume growth. During winter wheat green up, there are a few field activities that need to be considered, including winter wheat herbicide applications and winter annual weed burndown applications in no-till fields. However, most wheat fields in Indiana are now past the joint stage, which limits the number of herbicide options available for farmers that haven't sprayed their fields yet. The following information will outline winter annual weeds to look out for, weed scouting tips, crop stage restrictions, and herbicide recommendations.

Some common broadleaf weeds to scout for in your winter wheat are dandelion, purple deadnettle, henbit, chickweed, Canada thistle, wild garlic and annual ryegrass if you are in the far southwest part of the state. These winter annual species that emerge in the fall can remain relatively inconspicuous through the winter and become competitive and troublesome during the spring if not controlled early in the spring. Summer annual weeds such as ragweed will be of less concern in the early spring and will be outcompeted by the wheat crop if managed properly. Grass weeds to be aware of and scouting for are: annual bluegrass, annual ryegrass, cheat, and downy brome.

Determining the severity of weed infestations in your wheat fields is key in determining the necessity of a herbicide application. As with all agronomic crops, you should scout your entire field to determine what weed management practices need to be implemented and determine any areas of severe weed infestations. Wheat fields that contain uniform infestations of at least one broadleaf weed and/or three grass weeds per square foot should be taken into consideration for a herbicide application to avoid yield loss and harvest interference problems. Some fields that have less uniform infestations, but rather pockets of severe infestation should be managed to reduce weed seed production and future infestations.

When determining your herbicide program for spring applications, the stage of the wheat crop should be considered. The majority of wheat herbicides are labeled for application at certain wheat growth stages and some commonly used herbicides have very short windows in which they can be applied. The popular broadleaf weed herbicides 2,4-D and MCPA are efficient and economical, but can only be applied for a short period of time between tillering and prior to jointing in the early spring. Wheat growth stages and herbicide timing restriction are outlined in Figure 1.



¹Labels of some 2, 4-D products allow application after jointing but before early boot. (See text for more information.)

Figure 1. Feeke's scale of winter wheat stages and herbicide application timings (Source: 2020 Weed Control Guide for Ohio, Indiana and Illinois).

If weed infestations are severe enough to require a herbicide application, the use of liquid nitrogen fertilizer solution as a carrier is a popular option for applying herbicides and topdressing the wheat crop in a single pass over the field. Caution should be taken when using a liquid fertilizer as a herbicide carrier as moderate to severe crop injury can result, especially in saturated soil conditions. Many post applied wheat herbicide labels allow for liquid nitrogen carriers, but require different rates and types of surfactants than if the herbicide was applied with water as the carrier. Table 1 includes precautions to be taken when applying wheat herbicides using liquid fertilizer as a carrier; further details and directions can be acquired from the herbicide label.

Another consideration growers should take into account when planning early spring herbicide applications is the plant back restrictions to double crop soybeans. A large percentage of the herbicides listed in Table 1, especially those with activity on annual ryegrass and brome, have soybean plant back restrictions greater than the typical three month time period between spring applications and double crop soybean planting. The soybean plant back restrictions greatly reduce the number of options available to wheat producers who double crop soybeans after wheat. Refer to Table 1 for more specific plant back timing restrictions.

Air Temps And Herbicide Efficacy

(Bill Johnson) & *(Marcelo Zimmer)*

Every year growers may experience challenges when controlling winter annuals weeds or terminating cover crops with glyphosate, specifically when glyphosate is sprayed in cool weather conditions or tank mixed with atrazine or an atrazine premix. In 2018 we conducted cover crop trials at a couple locations and were able to capture some good images and weather information around those treatments. The purpose of this article is to provide some recommendations on how to achieve good herbicide efficacy during spring burndown and share our data and experiences with this situation in 2018.

We conducted cover crop experiments at three different Purdue Agricultural Centers over the last couple of years. One of the trial objectives was to look at the influence of termination timing on herbicide efficacy, weed suppression, and crop yields. Our cereal rye experiment provided a good data set to look at the influence of air temperatures on glyphosate and glyphosate plus atrazine activity. In Table 1, we are showing the data for two of our sites, Throckmorton Purdue Agricultural Center (TPAC) near Lafayette Indiana and the Southeast Purdue Agricultural Center (SEPAC) near Butlerville, Indiana. In table 1 we can see the daytime high and low temperatures for the two days prior to spraying, spray day, and the next two days after that. At TPAC, you can see that the two days before spraying we had daytime air temps that got up in the 50s and 60s, But night time air temps that got as low as 29° on the day of spraying. The next two days after the spray treatment was made, our nighttime air temps got down as low as 29°. If we look at the SEPAC information you can see that the two days before spraying, and the day of spraying nighttime air temps or down in the 30s and low 40s. The day after spraying we had a nighttime low of 42.

Table 1. Low and high air temperatures (°F) for two days before termination application to two days after application.

	TPAC Low	TPAC High	SEPAC Low	SEPAC High
2 days before application	50	60	41	55
1 day before application	39	50	30	59
Day of application	29	65	33	71
1 day after application	29	65	42	80
2 days after application	35	54	59	82

In figure 1 you can see images from the two research sites. At both sites you can see that Roundup alone is providing more control then Roundup plus Acuron at two weeks after treatment. The common thread with these results is the influence of cool nighttime temperatures on herbicide activity. For many years we focused our attention mostly on daytime air temperatures and its influence on herbicide activity. In our data set, daytime are temps are mostly in the 50’s and above. However, over the last 8 to 10 years we have become more educated on the influence of nighttime air temps on herbicide activity. The moral of the story is that daytime air temperatures may seem ideal for herbicide activity, but night time air temperatures can cause plants to slow their growth rates or shut down. We know that if plants aren’t actively growing, herbicide efficacy is reduced for translocated herbicides. Our general rule of thumb is that we want daytime air temperatures in the 50s and 60s and nighttime temperatures in the 40s or higher to assure plants are actively growing to maximize the effectiveness of postemergence translocated herbicides.

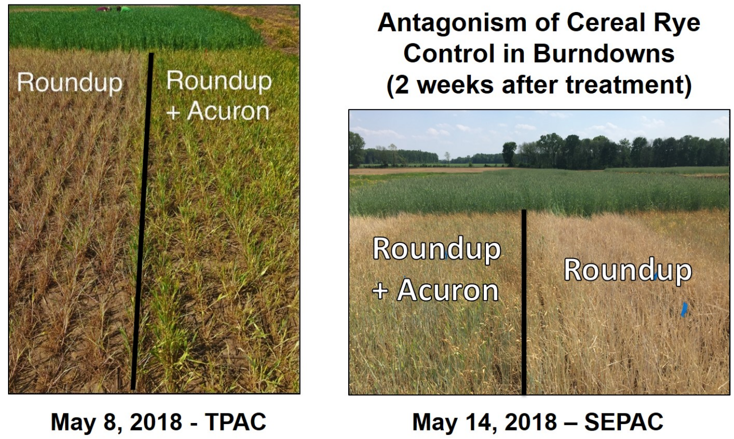


Figure 1. Picture of Roundup alone compared to Roundup + Acuron two weeks after herbicide application to terminate cereal rye.T

Baleage Practices For Success

(Keith Johnson)

Taking large round and large rectangular bales and wrapping them with white plastic to make bale silage (baleage) has become a common practice. A major reason for its adoption is to increase the chances of making quality forage when rainy weather does not permit making dry hay.

There have been a couple cases of botulism in the last year when small grain baleage was fed to cattle and horses. Proper fermentation is critical to reduce the chances of this tragic disease. The causative organism of botulism is the soil borne *Botulinum clostridium*. The toxin cannot form if the silage pH is less than 4.5. A contributing factor to the concern is a high ash content from soil contamination with harvest procedures.

The following are guidelines to successfully make and use baleage.

- **Crop quality** – Good fermentation is dependent upon a supply of readily fermentable carbohydrates. Overly mature forage will have less nonstructural carbohydrate.
- **Moisture content** – The best range of moisture content for proper fermentation is 50 to 60 percent. Uncut forage will be around 75 percent moisture. Generally the crop needs to wilt 6 to 24 hours to reach ideal moisture content to make baleage. Wilting time will be dependent upon crop type, yield, swath density and environmental conditions at harvest.
- **Reduce soil contamination** – During the tedding and raking procedures, set the equipment to reduce soil contamination in the swath and windrow.
- **Bale density** – A dense, tight bale improves fermentation as less pore space will be occupied by air. Proper fermentation requires an anaerobic environment.
- **Bale shape** – Bales should have similar outer dimensions so fewer air pockets result.
- **Time between baling and wrapping** – Bales should be wrapped as soon as possible after baling, ideally within 4 hours.
- **Bale binding** – Use plastic or untreated sisal twine, or plastic net wrapping to bind the individual bales at baling. Avoid treated sisal twine.
- **Plastic** – Tightly wrap each bale with six to eight layers of good-quality, 1-mil-thick plastic that is resistant to sunlight.
- **Storage** – Place the bales on a well-drained site. Inspect the bales often for the presence of holes in the plastic. Holes should

be covered with ultraviolet light-protected plastic tape that can be purchased from the plastic provider. Do not use duct tape. Storing individually wrapped bales on end reduces holes caused by raptors, if a problem, since there is more overlap of wraps on the ends of the bale.

- **Feeding** – Utilize the bales within a year to reduce storage loss. Unwrap plastic on the baleage just prior to feeding to the livestock.

Following these guidelines should improve fermentation and baleage quality. When quality analyses are being done at a forage quality laboratory, it would be advised to get a pH measurement, too, to determine whether excellent fermentation was achieved.

Wrapping hay for baleage.

When Should Corn Planting Begin?

(Bob Nielsen)

The short answer to the question posed by the title of this article is: "*Whenever you want to begin planting corn*." After all, it is your choice, right? The even shorter answer to the question is the typical Extension Specialist answer: "*It depends*." The decision about when to begin planting corn depends on your ultimate goal.

- If your goal is to simply check out the operation of the planter or the "fitness" of the field conditions, then go for it.
- If your goal is to begin planting early to rile up the neighbors, then go for it.
- If your goal is to avoid the late planting frustration of last year, then go for it.
- If your goal is to begin planting at the earliest crop insurance date to qualify for replanting payments, then go for it.

Understand that planting early with those goals in mind tends to ignore the possible consequences of unacceptable stand establishment that might occur due to cold soils, frost or freeze injury, or planter furrow soil compaction (especially smeared sidewalls).

- If your goal is to plant when soil conditions are "fit" AND soil temperatures are suitable for rapid germination and emergence and stand establishment, then there are some considerations worth noting.

One of the key factors in setting the stage early for maximum grain yield at harvest is the success or not of the stand establishment process. This includes the success of germination, the success of emergence, and the success of the initial rooting of the young plants from about the 2-leaf collar stage (V2) to about V6. Successful stand establishment requires adequate and uniform seed-to-soil contact at planting, adequate and uniform soil temperature, adequate and uniform soil moisture, absence of soil crusting, absence of planter furrow compaction, and minimal or no soil-borne pests. That's not asking for much, is it?

Soil temperature, in particular, is a key driver of the success of germination and emergence. It requires approximately 115 Growing Degree Days (GDD) after planting for a corn crop to emerge.

This GDD "threshold" for corn emergence, if you want to call it that, is more consistent if you calculate GDD using soil temperatures rather than air temperatures.

The faster corn germinates and emerges, the fewer number of days the seeds or young seedlings are exposed to other stresses. To put it in a calendar perspective, corn could emerge 7 days after planting if daily AVERAGE soil temperatures were consistently 66-67F (16-17 GDDs per day x 7 days). However, if AVERAGE daily soil temperatures averaged only 55F from planting to emergence (equal to 5 GDD per day), emergence would not occur for about 23 days after planting.

The astute reader will immediately recognize that the odds of cool soils in Indiana are greater in early April than late April. Consequently, I believe caution should be exercised when considering whether to begin planting in early April throughout much of central and northern Indiana.

However, once the calendar moves ahead to about the third week of April, the climatological odds are in our favor that soils will warm up consistently over the coming weeks and so soil temperatures become less of an issue. In fact, most farmers intuitively recognize this fact as evidenced by historical statewide planting progress that indicates that significant planting of corn in Indiana typically begins in that third week of April (USDA-NASS, 2020).

So, like I said at the outset... It's your choice when to begin planting corn. Make sure you choose wisely.

Related References

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Nielsen, R.L. (Bob). 2019. The Planting Date Conundrum for Corn. Corny News Network, Purdue Extension. http://www.kingcorn.org/news/timeless/PltDateCornYld.html. [URL accessed Apr 2020].

USDA-NASS. 2020. Crop Progress. USDA National Agricultural Statistics Service. https://usda.library.cornell.edu/concern/publications/8336h188j [URL accessed Apr 2020].

Managing Grain In The Spring

(Klein Ilelji)

It's getting to be quite a challenging start in the year from getting out of a late wet harvest season to now dealing with the disruptions of life and services as we know it due to COVID-19 pandemic. I would like to use this article to address some issues you might have to deal with related to managing stored grain in the spring. This article will focus on (1) drying grain that was not adequately dried when it was binned in the fall or winter, (2) monitoring and managing grain in storage through the spring into the summer and (3) safely unloading grain from your bin.

Drying grain that was not adequately dried when it was binned in the fall or winter

First of all, it is important to know what moisture content you need to be storing your grain at given your short and long-term marketing plans. How long you intend to store your grain will determine the level of moisture content to store your grain at. Table 1 provides a guideline on maximum moisture contents at storage periods from up to 6 months to over one year for various grain types. Note that the longer you intend to hold your grain, the lower the level of moisture you need to be. This is very important especially if you would be storing your grain through the warm summer months, when managing grain becomes more challenging, and the potential for insect and mold problems increases. Please note the caveat below the table headline – *reduce safe storage moisture content by 1% for poor quality grain.*

Table 1. Maximum moisture contents for grain harvest and safe storage recommended in the Midwest. (Source: Grain Drying, Handling and Storage handbook, third edition, MWPS-13). Values for good quality, clean grain and aerated storage. Reduce safe storage moisture content by 1% for poor quality grain.

Grain type	Maximum moisture content, %wb			
		Storage period		
	At harvest	Up to 6 months*	6-12 months**	>1 year**
Shelled corn and grain sorghum	30	15	13	13
Soybeans	18	13	12	11
Wheat, barley and oats	20	14	13	12
Flaxseed	15	9	7	7
Canola	14	9	8	8
Sunflower	17	1-	8	8
Edible beans	16	16	13	13

*Up to 6 months from harvest refers to storage under winter conditions.
**6-12 months and >1 year storage refers to storage into the warm summer months.

So what should you do, if you were not able to dry your corn or soybean in the fall or winter to the safe levels indicated on the table. This is the time you need to begin implementing natural air/low temperature drying using your aeration fans, and/or with a little addition of heat if you have burners on your fans. Typically, you will not accomplish drying in a reasonable amount of time for the fan run-time hours used if the air temperatures are below 40°F and humidities are above 70%. As the temperatures warms up in the Spring, ambient air temperature becomes more favorable for drying using natural air. Natural air drying is recommended if your grain was binned at 18% moisture and you just need to remove just about 3 to 4 percentage points of moisture. Otherwise, if you need to dry grain that is 19% or more, you should consider using a low temperature in-bin dryer (aeration with the addition of heat, +5-10°F) and a high temperature dryer (180°F or more air temperature), especially for higher moistures to get that moisture down as quickly as possible. Shallower grain fill depths or larger diameter bins favor in-bin drying. This is because the storage life of your grain reduces with increasing temperature and grain moisture content. The warmer the weather becomes the faster your grain loses storage life if held at higher than safe moisture levels. Care needs to be taken to dry soybean in order to prevent split beans. Ensure than drying air humidity levels are not below 40% when drying soybean with medium (120-140°F) or high-temperatures (160-180°F).

The following are things to check for before and during drying your grain:

- Turn on your fans and be alert to check for odor that indicates active deterioration. If active deterioration has begun, you should consider using a high-temperature dryer and moving the grain out of the bin to market sooner than later.
- Check to see if there are signs of molding, crusting or germination on the surface of the grain by looking down from the manhole on the roof. Molding or crusting can be recognized by discolored black patches on the grain. Black moldy patches are not easily discernible. Before you open the manhole, run your fans for atleast 30 minutes to ensure you exhaust any lethal gas build-up in the bin. Inhaling very high CO_2 levels, which can be caused by grain spoilage can be lethal. Also make sure that you have at least two persons with you on the ground before opening the manhole.
- If you did not core the center of the bin when it was being filled, you should consider doing this now. Coring reduces the levels of broken kernel and foreign materials, which lodge at the center of the bin during filling, and helps improve airflow through the grain bulk. Coring helps ensure air flows through the center of the bin, which reduces the possibility of spoilage and blockage during unloading. A rule of thumb when coring a bin is to pull out 1/3 to 1/2 the bin diameter, so that you have an inverted cone at the surface (See Figure 1).
- Do not run your fans when it is raining or it is foggy. The ambient air condition during these periods will rewet the grain rather than dry it. Take advantage of warm good sunshine days to run your fans.
- The expected fan runtime to dry your grain using natural air in-bin drying depends on the initial grain moisture, airflow (having at least 1 cfm/bu is good) and air properties (warm low RH air is good). Monitor to see the drying front has gone through the whole grain bulk by regularly pulling samples from your bin, probably weekly using a grain probe (trier). While you will not be able to sample every depth, it is important to ensure that the drying front reached the grain surface. In a positive pressure aeration system, where fans push air from the bottom of the bin, the drying front progresses from the bottom up. The goal is to move the drying front as fast as possible through the grain mass. So pull samples weekly from the top of the bin to a depth of up to 6 ft if possible, using a grain probe (trier) to monitor the progress of drying. Pull grain samples from the bin center and a radial distance about half-way from the center to the bin wall. If you have temperature cables in your bin, closely monitor grain temperatures across the bulk to determine if the grain are equilibrating to ambient conditions or heating up above ambient. Some temperature cables in newer grain monitoring systems also have RH sensors that determine grain equilibrium moisture contents as well, and can be used to track the progress of the drying front.
- Once you have achieved your target moisture, your goal should be to cool back your grain bulk by aeration to preserve storage life, slow insect pest development and reduce risk of spoilage. Take advantage of cool spells during the spring to cool the grain bulk. Also, turn over the air in the headspace to prevent condensation at night by running the fan exhausts on the bin roof for 1 to 2 hours. The purpose is to remove the warm humid

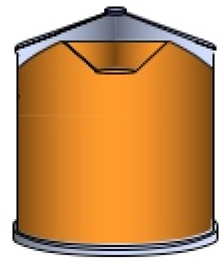
air that builds up in the headspace at daytime, which condenses on the cool bin roof surface or grain spouts at night, and drips back unto the grain surface.

Monitoring and managing grain in storage through the spring into the summer

It is important that you be proactive in managing your stored grain through the spring and summer. Remember that even when you have grain stored at a safe moisture content, storage problems could still occur from an undetected leakage that results in hotspot development, or surface crusting and spoilage from condensation. Proactive management involves constant monitoring to make sure that your grain is still in good condition. First, for grain that was binned after drying to safe moisture, spring management involves ensuring you maintain the cool tempertaures achieved from winter aeration. It would be necessary to cover your aeration fans to prevent passive warming up of the plenum and bottom of the bulk when fans freely spin from wind. To control condensation, it would still be necessary to run the exhaust fans on the bin roof at night, which only turn over the air in the headspace and doesn’t warm up the entire grain bulk.

Monitoring is difficult without taking measurements of the grain bulk condition that indicates the condition of grain bulk. Should you have temperature cables in your bin, recording these tempertures on a constinous basis is a good way to track the condition of the grain. Constant tracking of grain temperaures by using software that log data hourly and present the data in a format, for example, temperature at various depth in the bulk over time, and comparing to the ambient is better than manual readings and logging of data. The history of temperature data of the bulk provides more insight than the particular temperature of the bulk in a given day. Remember, the grain bulk temperature changes based on the ambient air conditions used to aerate the bulk. Because grain is a good insulator, it does hold its cool temperature once its been cooled and it takes time to warm back up as the ambient temperature warms up in the spring. Should the bulk or a section of the bulk show signs of warming up faster than the ambient, this is a sign that active spoilage is occurring. Aeration will help retard the rate of deterioration in the event of active spoilage, but will not stop it. Consider moving the grain to market when you detect that active deterioration might have begun in your bin.

The presence of deterioration can be monitored by measuring the level of CO_2 in a grain bin. The rate of CO_2 production from a grain bulk depends to the grain moisture, temperature and levels of mechanical damage, fines or broken corn. For most part, grain is a living organism and will respire giving off CO_2. However, high levels of grain moisture and temperature promotes mold growth such that CO_2 production in high moisture corn is dominated by mold consumption of carbohydrates in the presence of oxygen, with CO_2, water and heat produced in the process. CO_2 levels exceeding 600 ppm and climbing is an indication of poor storage condition and levels exceeding 1,000ppm indicates active deterioration is occurring. While CO_2 monitoring will indicate poor storage conditions earlier than temperature cables would, the challenge with its use is how to quantify the level of deterioration occurring and how to integrate monitors into storage bins. The use of portable CO_2 monitors for measuring CO_2 levels from fan exhausts on bins or grain piles using negative pressure aeration is systems is easy to implement, but more challenging with positive pressure aeration systems where exhausts are on the roof. To conclude, it is important to view the goal of monitoring as being proactive to detect when conditions are favorable for deterioration to occur so that timely measures can be taken to retard its progress or move the grain to market, rather than determine when active spoilage has begun. Also, note that sampling grain biweekly to determine moisture content is also a good monitoring practice, but most be implemented with extreme care because you would need to enter a confined space. If grain has been removed from the bin, entering the bin to sample grain can be hazardous and should be done with extreme caution. In all situations with entering a bin to sample grain, you must first determine that the surface has not bridged; that is having a crusted solid surface below which lies an air pocket. Use a long pole to poke the center and various parts of the grain surface to make sure the surface is not bridged. Entering a bin must be done with careful planning, conveying auger lock-out/tag-out procedures in place, and in the presence of 2 or more people.



An illustration of a cored bin after the fines and broken corn has been pulled from the center, enabling better airflow during aeration (Figure is courtesy of Dr. Sam McNeill, University of Kentucky).

Safely unloading grain from you bin.

It is important that you are able to safely unload your bin to move your grain to the market when you want to do so. Because of the wet conditions during the harvest in the fall/winter, and the challenges many encountered with drying grain to a safe moisture, we might experience more challenges with unloading grain bins this year. Blockages of unloading pits, jammed augers, crusting, compacted grain and grain stuck to bin walls may be a common occurrence in grain bins this year. This will result in situations when farmers and or personnel are forced to enter bins to dislodge grain. First remember, a grain bin is a confined space and pose a hazard to personnel working inside it. Follow recommended guidelines for safely working in grain bins; never work alone. Make sure you discuss the dangers and precautionary measures taken while working around grain bins with your family and all your staff. Never enter a grain bin when the unloading auger(s) is/are still on. Practice log-out/tag-out procedures for your unloading augers before anyone enters the bin. Ensure that there are atleast 3 persons and that the person entering the bin is tied to a lifeline and has the proper gear (respirator and harness). Try to dislodge grain stuck to the walls using a long pole from outside the bin rather than entering to dislodge from inside. Grain stuck to bin walls can easily avalanche and bury a person below once it becomes loose. Again, think seriously of ways to safely dislodge grain from outside the bin when unloading bins rather than from inside. Never jump into a mass of grain static or flowing, and never work alone in a grain bin. Another thing to consider is to warm-up grain to the ambient air temperature prior to unloading it, in order to prevent condensation of moisture on cool grain during unloading on a warm day. For small loads you may need to unload to ground for feed, don’t warm up the whole bin, but rather warm up the small load after unloading. Remember, the longer you keep grain cold, the better it would preserve both from mold and insect pests. Lastly, it might be a good idea to move some grain out of the bin from time to time to loosen up the bulk. The grain pulled-out can be put back or moved to another bin especially if you have a spare bin to move grain into. Overall, practice safety first and take time to think through what you are doing before you act. While social distancing may keep us safe from the COVID-19 virus, calling up your neighbor, county extension office or co-worker to discuss your options before you enter your bin could very well prevent you from endangering yourself.

Stored Grain Handling And Management Webinar – Addressing Pressing Issues This Spring/Summer

(Klein Ilelji)

Time: Wednesday, April 22 at 10 a.m. ET.

Summary:

This webinar brings a group of six experts in grain post-harvest from industry, the North Central and South regions of US land-grant universities to directly address questions and discuss solutions that may arise related to grain handling and storage on-farm or at the elevator. The panel style format will be moderated by three experts and topics will focus on:

- grain conditioning (drying grain stored wet through the winter, condensation management, etc.)
- stored grain management (temperature management, monitoring methods and tools, etc.)
- handling (issues with jammed discharge wells, preventing blockage during unloading, etc.)
- safety (safe practices during unloading, how to assess situations and mitigate dangers, etc.)

Panelist

Ken Hellevang, Interim Chair, Professor & Extension Engineer, North Dakota State University
Carol Jones, Professor & Buchanan Endowed Chair, Oklahoma State University
Dirk Maier, Professor & Extension Engineer, Iowa State University
Chuck Schwab, Professor & Post-Harvest Safety Specialist, Iowa State University
Sammy Sadaka, Associate Professor & Extension Engineer, University of Arkansas
Bob Marlow, Consultant, Grain Quality & Facility Operations

Moderators

Klein Ileleji, Professor & Extension Engineer, Purdue University
Sam McNeill, Extension Professor, University of Kentucky
Janie Moore, Assistant Professor, Post-Harvest Engineering Education, Texas A&M University

To register for the webinar, go to this link: https://attendee.gotowebinar.com/register/5916473574663392781

Was March Any Indicator Of The Next Few Months?

(Beth Hall)

Staying true to global climate trends these days, March 2020 finished warmer and wetter than the 1981-2010 climate normal period. Snowfall across the state was below normal and flooding was a common feature across the state. Remarkably, there were 3 to 5 more rainy days than average across Indiana in March. This has led to saturated soils throughout the state and a desperate need for some drying out.

Modified growing degree days (50/86)* have begun to accumulate, and seem to be relatively comparable to 2019 accumulations (*Figures 1 and 2*).

Will this excess rainfall and above average number of rainy days continue to happen? What about these warmer temperatures? The national Climate Prediction Center is currently sending mixed messages. The April *monthly* outlook suggests increased confidence in temperatures being warmer than average and slight confidence that precipitation will be above normal. However, shorter-range outlooks (*i.e.,* 8-14 day and 3-4 week) are suggesting even greater confidence for cooler temperatures throughout the rest of the month. At this time, it does not look as if April 2020 will be as wet as April 2019. However, delayed planting may be necessary due to wet and cool conditions so keep an eye out for those dry periods to get condition monitoring and planting in when you can!

To keep track of recent frost/freeze data and explore climatological probabilities of frost/freeze events still occurring, check out the Midwestern Regional Climate Center's Vegetation Impact Program's Frost Freeze Guidance products. This suite of tools can show the date of the most recent freeze event (32°F and 28°F), how many days since the last freeze event (can be an indicator of early growth and green-up), how many frost/freeze days have occurred over the past 14 days and a variety of freeze climatologies.

**Modified growing degree days are similar to growing degree days but use cutoff temperature thresholds of 50°F (minimum temperature) and 86°F (maximum temperature). So, if the minimum temperature was 42°F and the maximum temperature was 90°F, then instead of averaging those 2 values and subtracting 50, the minimum and maximum threshold temperatures would be averaged (e.g., (50 + 86) / 2) and then subtract 50. This is used to account for vegetative growth response to temperature extremes.*

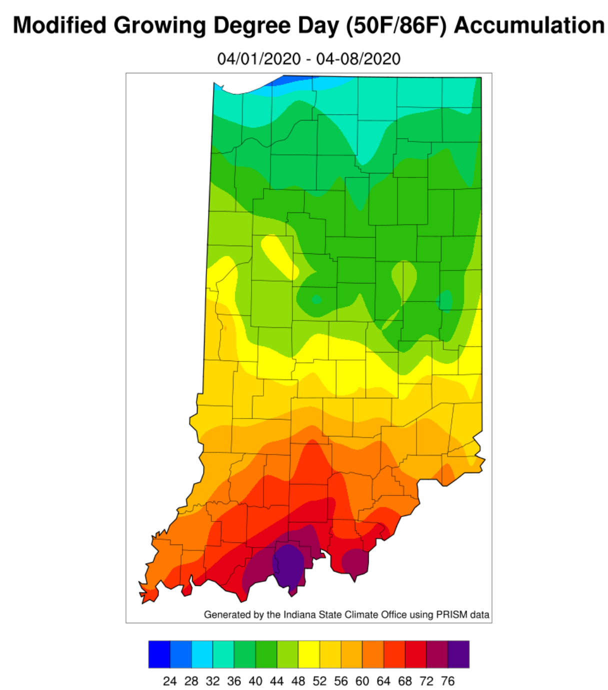
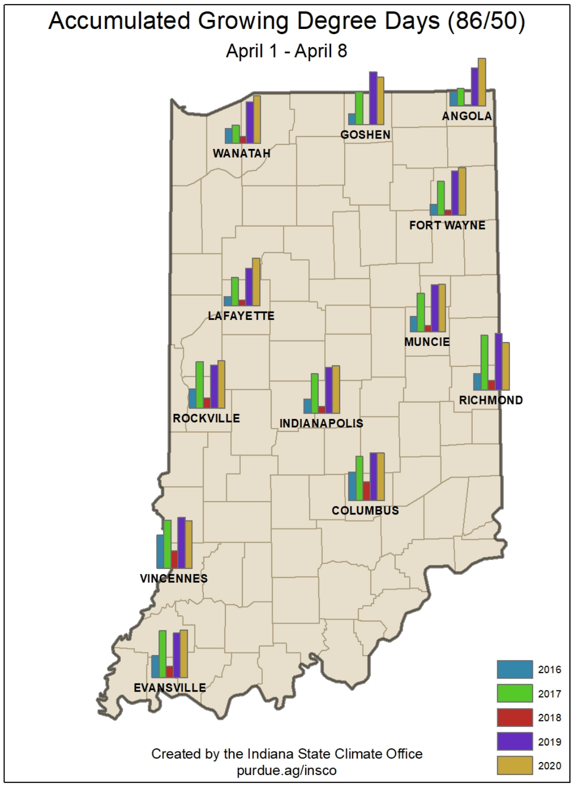


Figure 1. Accumulated modified growing degree days since April 1 through April 8 using minimum temperature threshold of 50°F and a maximum threshold of 86°F.

Figure 2. Comparison of accumulated modified growing degree days (50/86) for April 1-8 for 2016 through 2020.



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